



Cloud Aerosol Report

**Cloud / Aerosol Working Group Meeting
AURA Science Team Meeting
Pasadena
October 1-5, 2007**

Ben Veihelmann - Progress and results of the OMI aerosol product (OMAERO) using the multi-wavelength algorithm

Remco Braak - Validation results of the OMI multi-wavelength aerosol algorithm (OMAERO)

Myeong-Jae Jeong - Comparison between OMI and MODIS Deep Blue aerosol products

John Livingston - Comparison of Airborne Sunphotometer and OMI Retrievals of Aerosol Optical Depth during MILAGRO/INTEX-B

Omar Torres - Validation results of the OMI near UV aerosol products

Joanna Joiner – Status of OMI Cloud Products

Dong Wu – MLS V2.2 cloud products, plans for V3 algorithms, and cloud research

Steven Massie - HIRDLS Observations of Clouds

AnnMarie Eldering- TES Improvements

Curtis Rinsland – ACE Observations of PMCs and PSCs

OMI

- non-spherical desert dust aerosol models
using spheroidal shapes,
 T -matrix and geometric optics simulations
- across-track distribution of AOT
sensitive to particle shape, phase function
artifact is reduced using non-spherical models
- global average AOT slightly reduced

Results of OMAERO-MODIS Comparisons

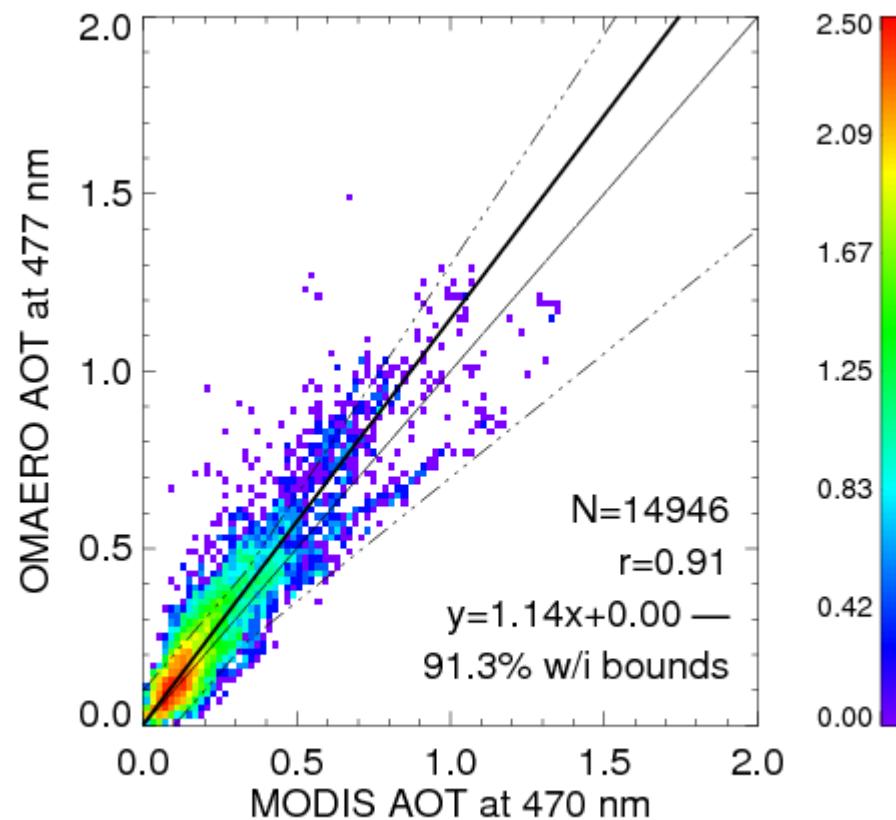
1-8 June 2006

Oceans worldwide

No sunglint

ALL collocations
(regardless of OMI/MODIS
coverage and MODIS QA)

Only pixels completely
covered by sufficiently
cloud-free and quality-
assured MODIS pixels



Good agreement with quality-assured MODIS AOT

Results of OMAERO-OMAERUV Comparisons

1-21 June 2006

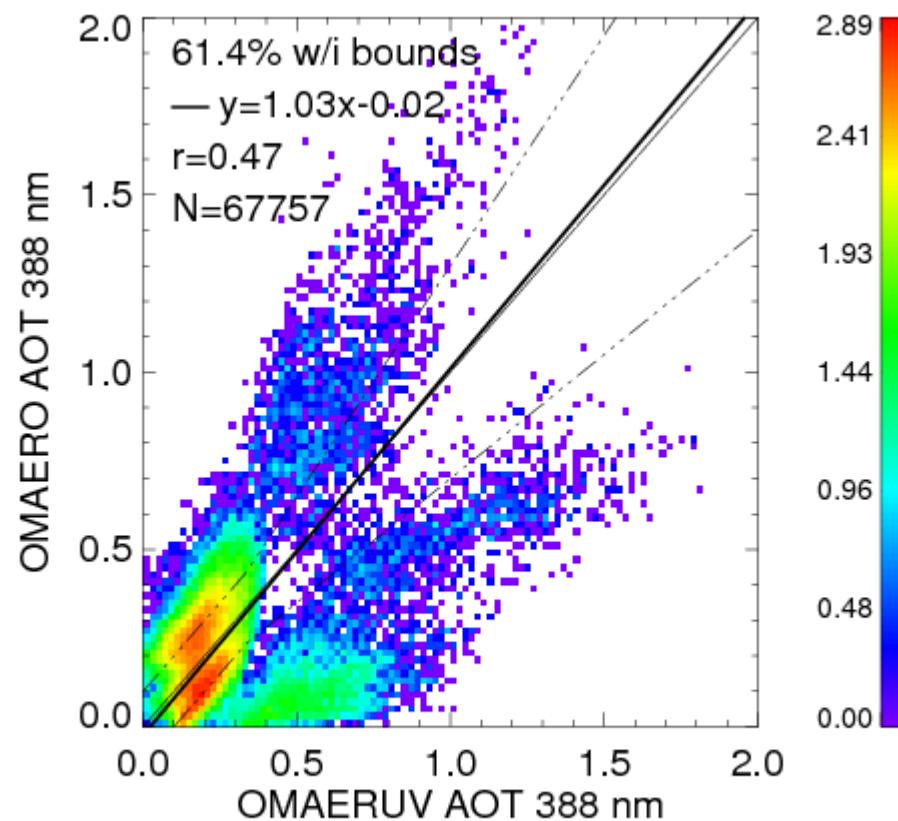
Oceans worldwide

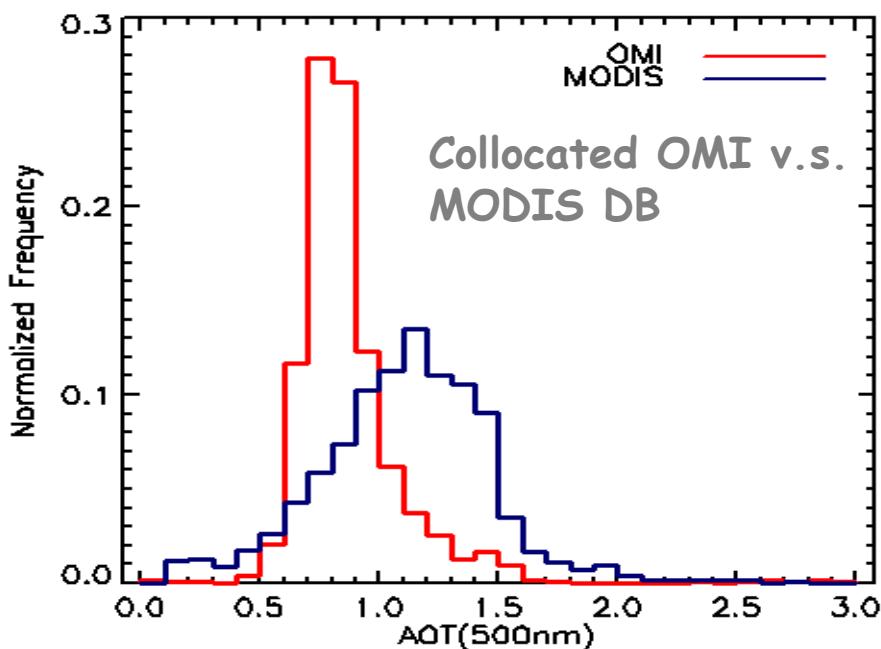
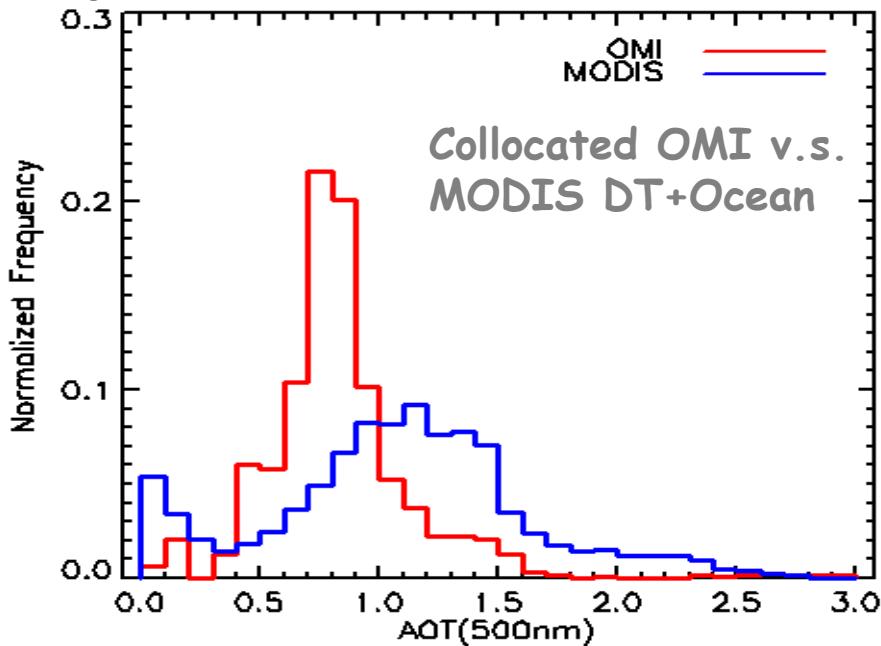
No sunglint

OMAERUV QA=0 only

Multimodality may be due to:

- Differences in type attribution
- Enhanced by cloud contamination and differences in surface albedo





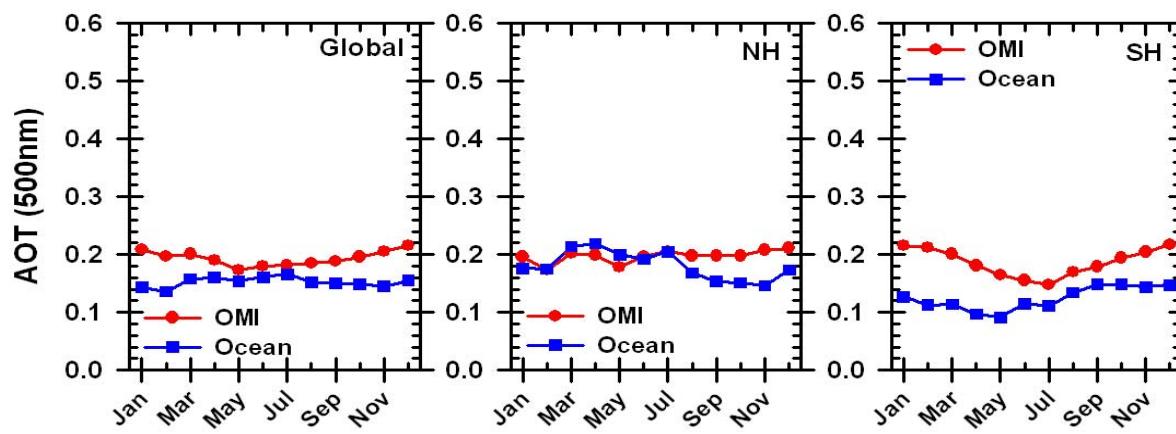
Saharan Dust: Transported (continued)

Granule Statistics Summary

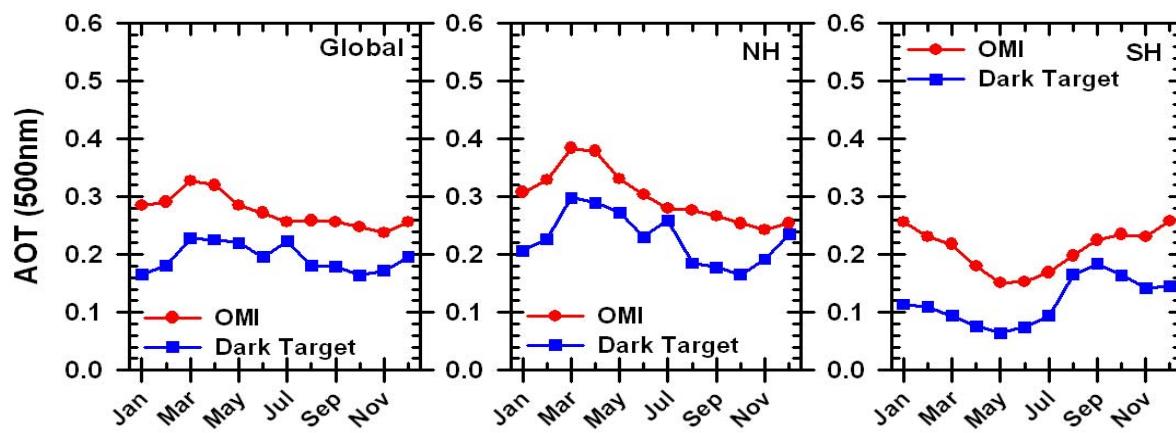
- Histogram for MODIS (Dark Target, Ocean, and Deep Blue) showed broader spectra.
- OMI median is lower than MODIS.
- OMI has lower frequency for low AOT (e.g., $AOT < 0.4$). → present consistently for all the three cases shown here.

*MODIS AOT is interpolated at 500nm using Angstrom Exponent.

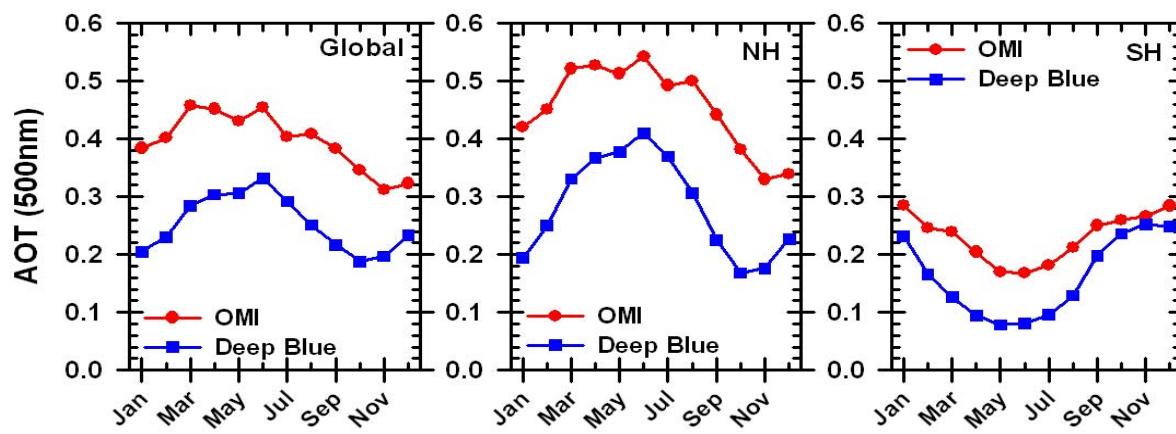
Monthly Variation of Global and Hemispheric Mean AOT* (500nm) in 2006



MODIS Ocean
v.s. OMI



MODIS Dark Target
(Land) v.s. OMI

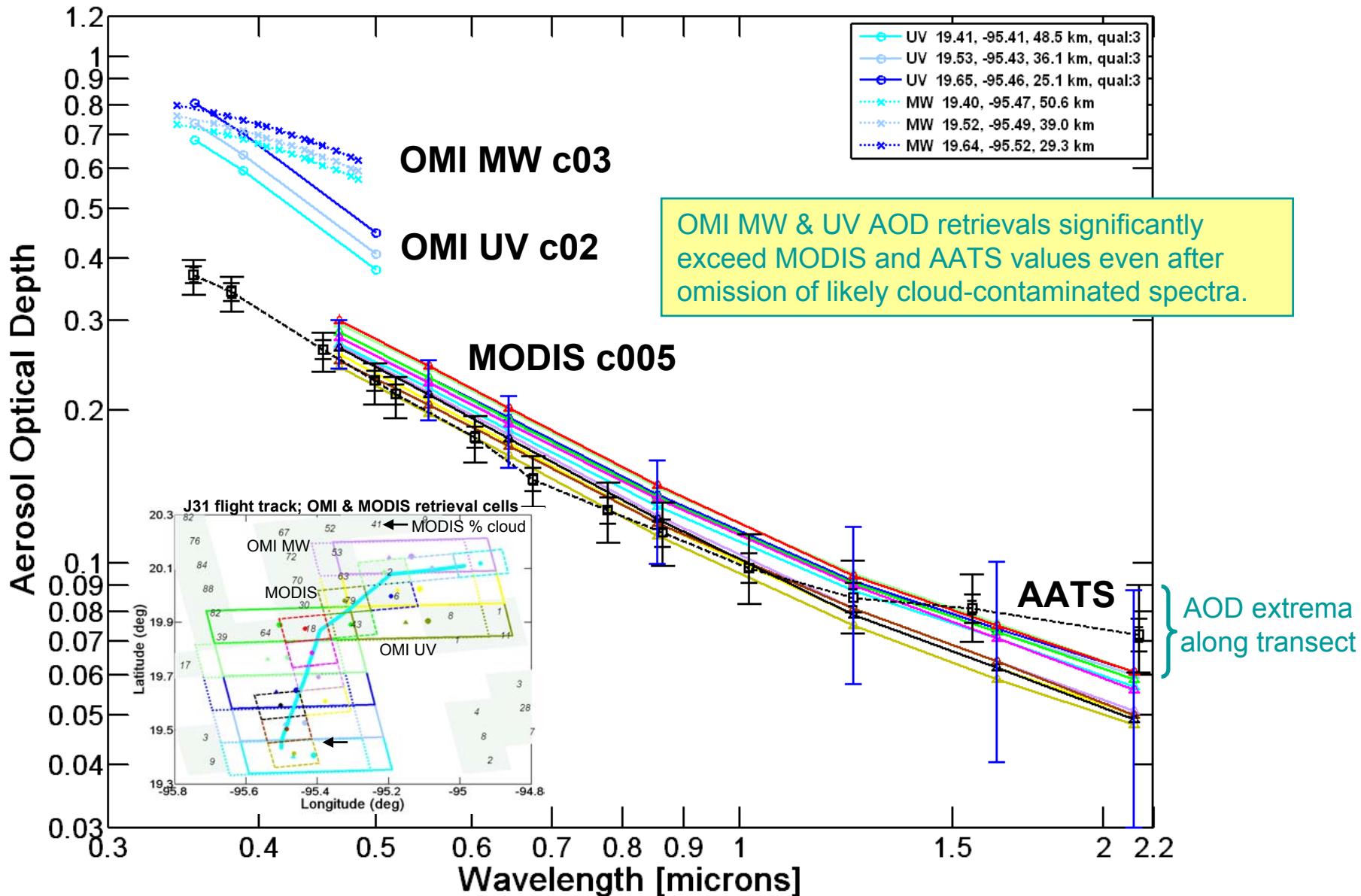


MODIS Deep Blue
(Land) v.s. OMI

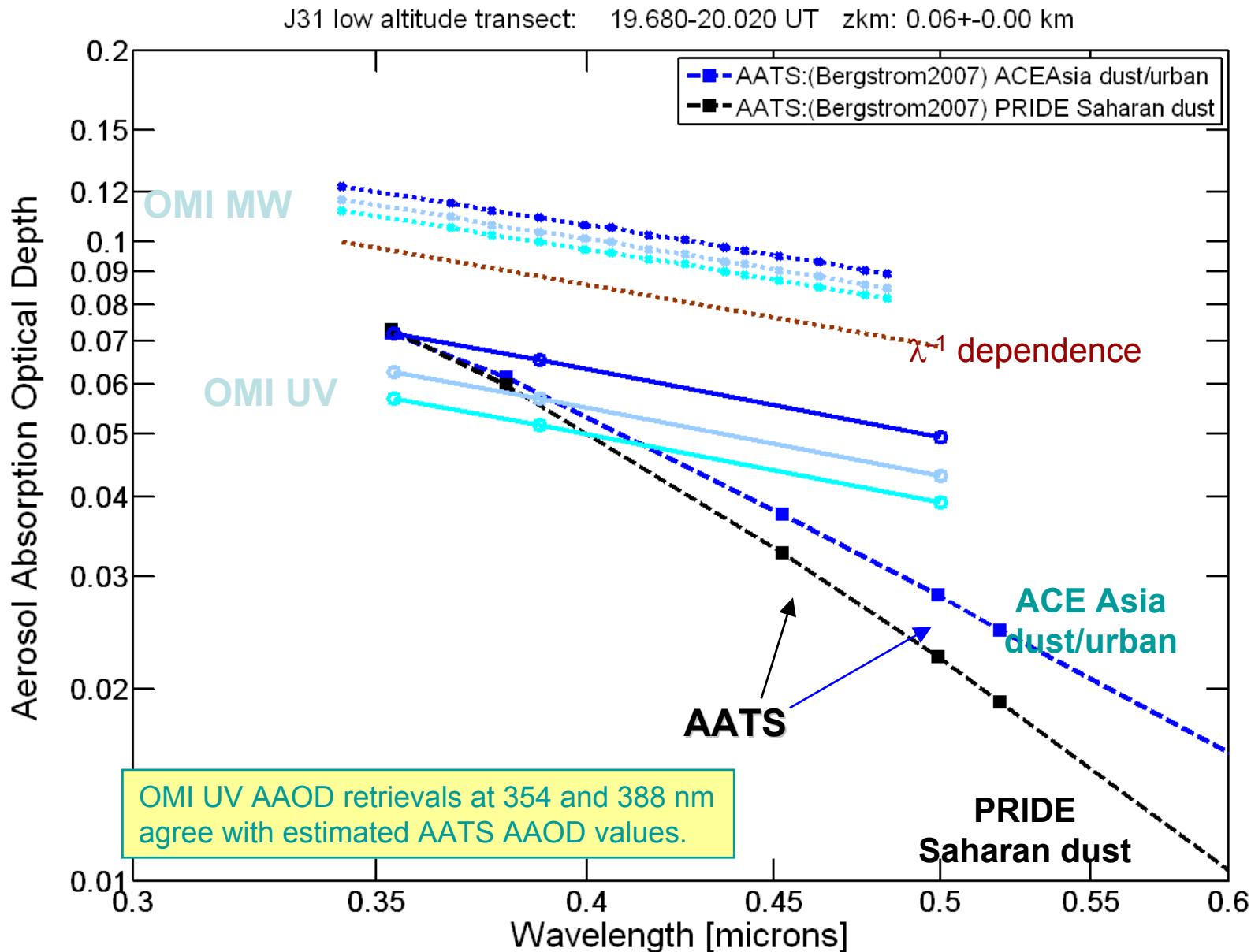
*MODIS AOT is
interpolated at 500nm
using Angstrom
Exponent. Jeong

10 March 2006 (over water)

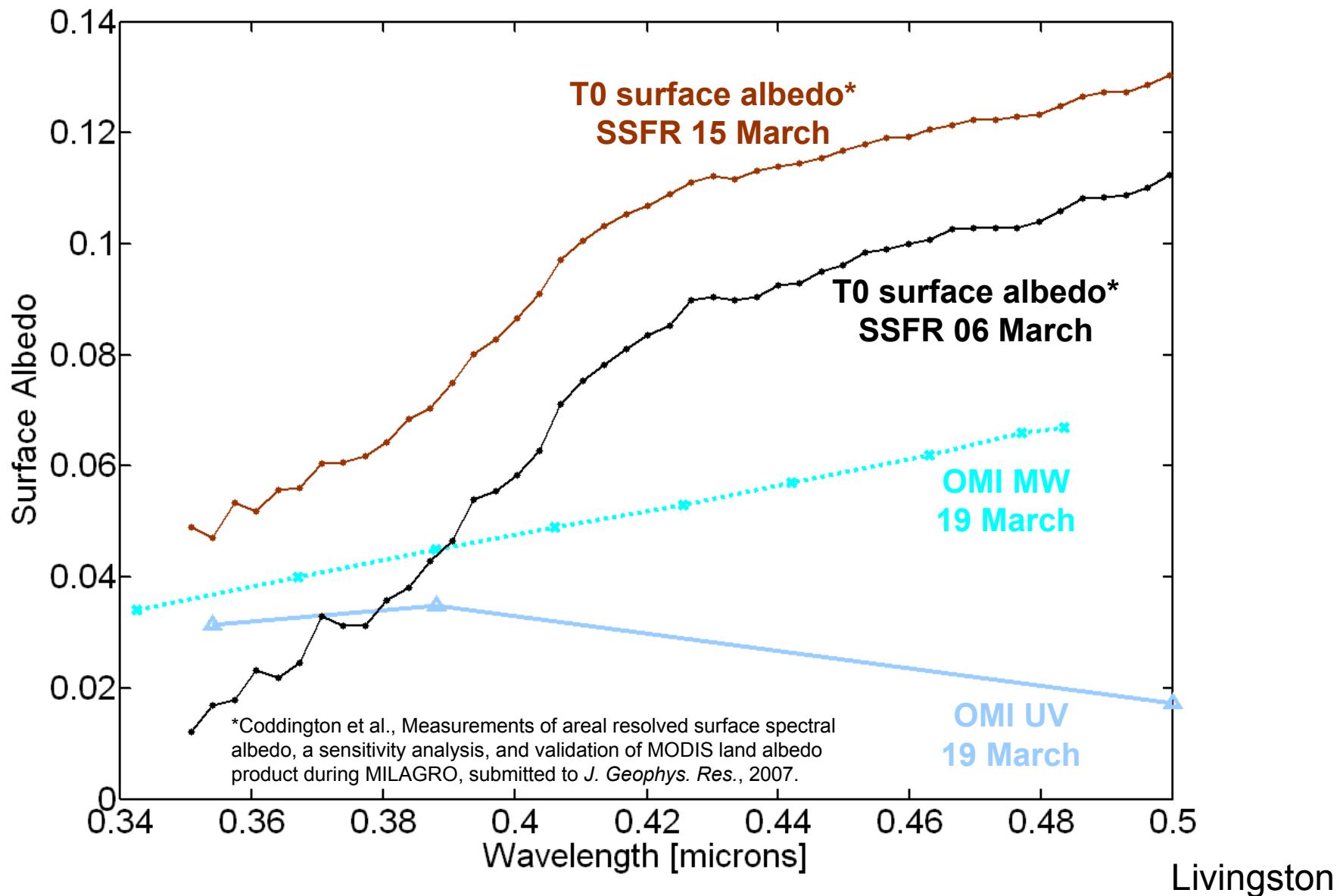
J31 low altitude transect: 19.680-20.020 UT zkm: 0.06+-0.00 km



Aerosol Absorption Optical Depth for 10 March 2006

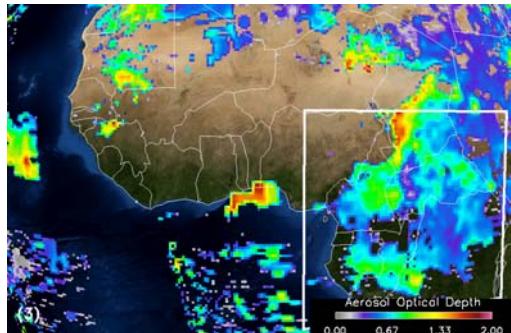


SSFR T0 Surface Albedo Retrievals for 06 & 10 March; OMI Retrieval Surface Albedo Assumptions for 19 March

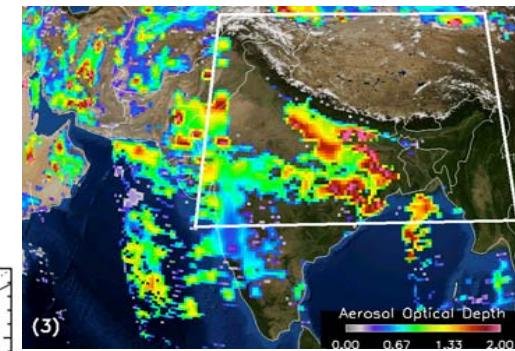


OMI Aqua-MODIS comparison of retrieved AOD

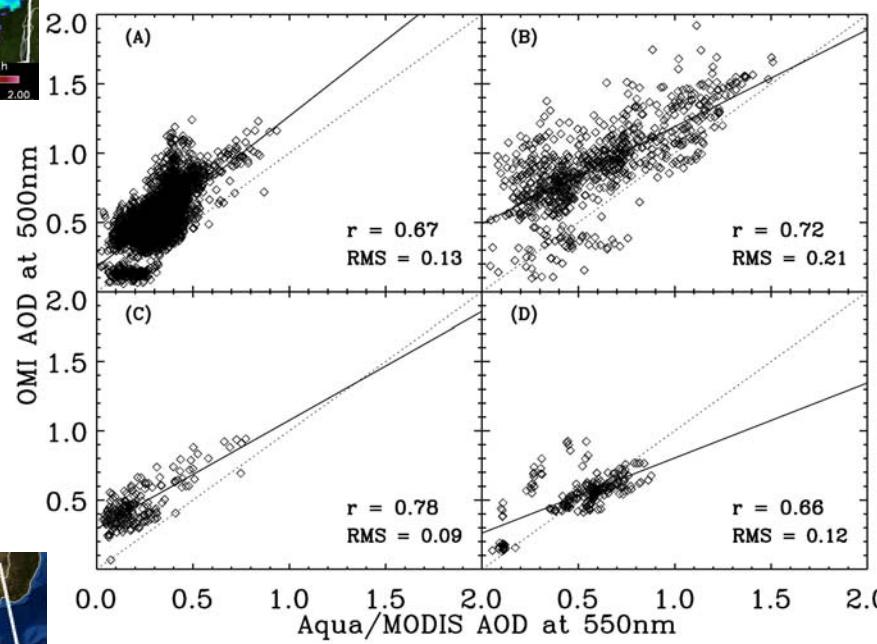
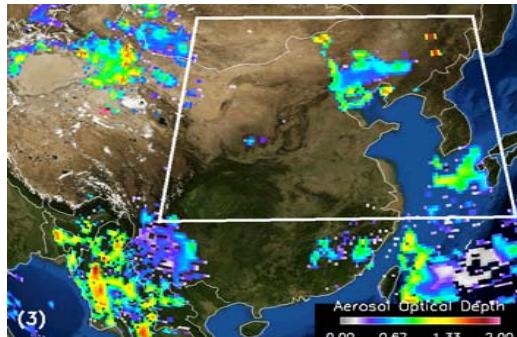
(A) Jan 2, 2007, biomass burning



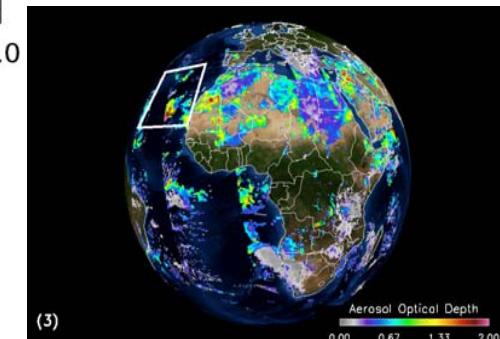
(B) May 14, 2006, Pollution Aerosols



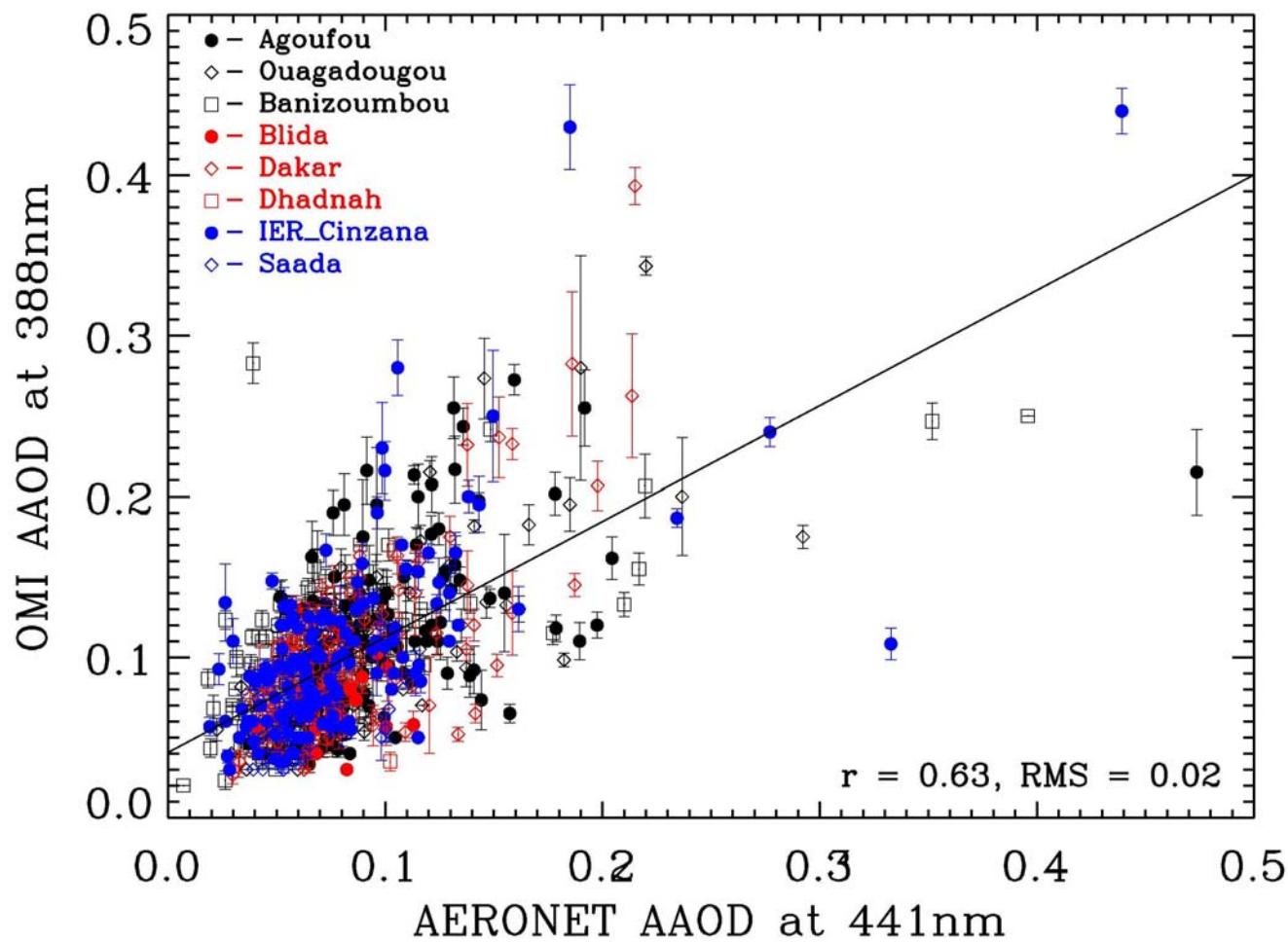
(C) March 10, 2006, Asian dust



(D) August 15, 2006, Saharan dust



OMI-Aeronet Comparison of Absorption Optical Depth Dust Aerosols

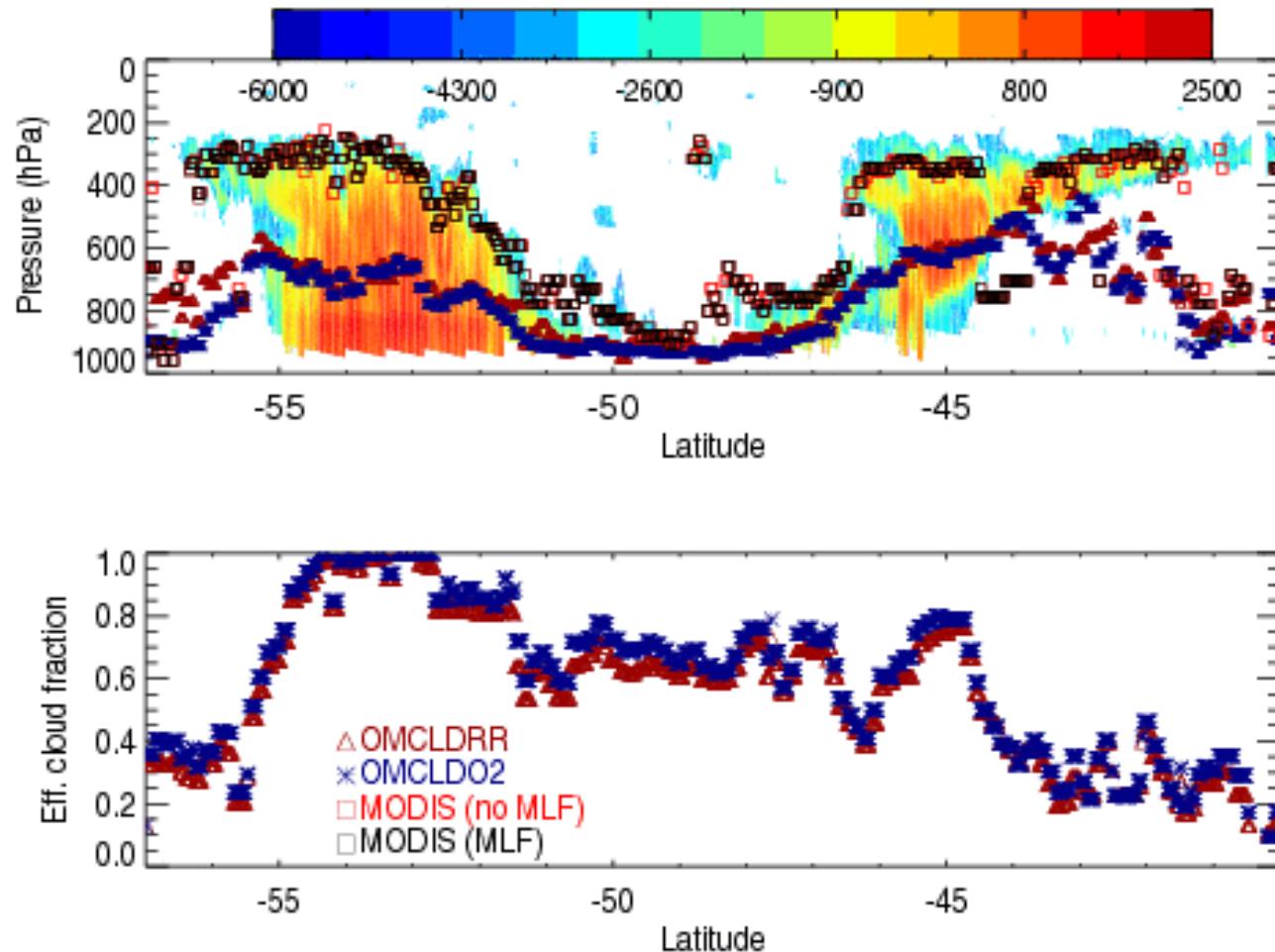


RMS: 0.02

Status of OMI cloud products

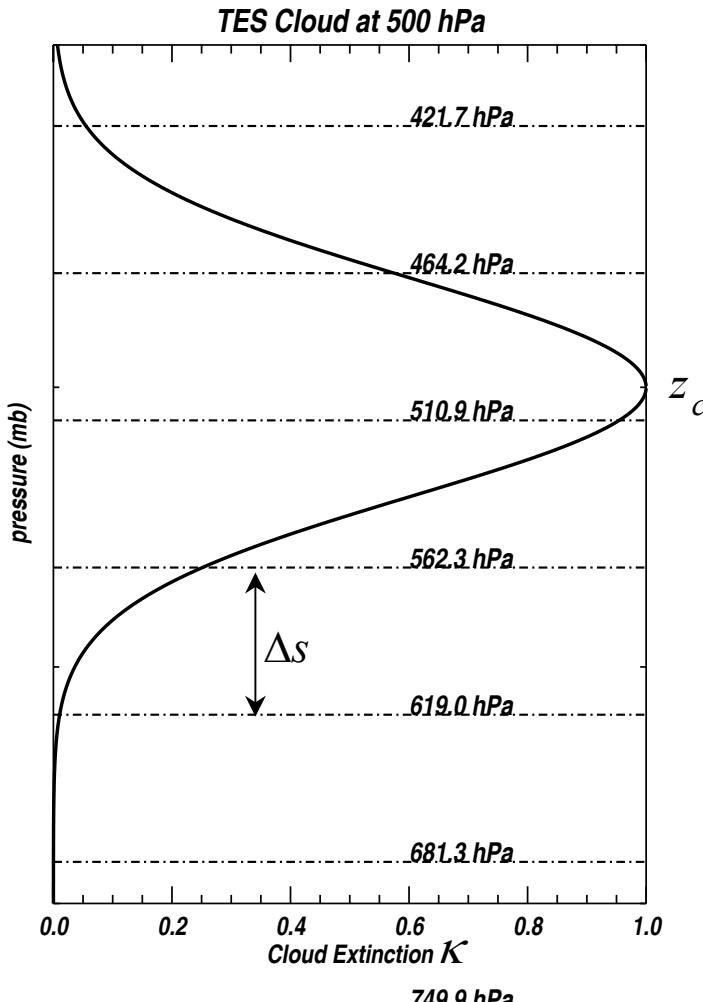
- Two OMI cloud products (both based on photon path):
 - O_2-O_2 absorption at 477 nm
 - Rotational-Raman scattering at 350 nm
- Both techniques measure a “radiative cloud pressure” that is appropriate for use in UV/VIS trace-gas retrievals
- This cloud pressure is distinctly different from cloud-top pressure reported from thermal IR (e.g. MODIS, AIRS) – don’t use thermal IR for validation
- Validation effort has focused on use of Cloudsat and internal consistency (also compared with O_2-A band on PARASOL POLDER)

Joiner



- Good agreement between two OMI products
- Good agreement with simulations based on Cloudsat (will be shown in Joiner's talk)

TES CLOUD PARAMETERIZATION



- Single cloud layer modeled as a Gaussian profile
- Absorption and scattering modeled with an effective tau discretized on a coarse frequency grid 25 – 100 cm⁻¹

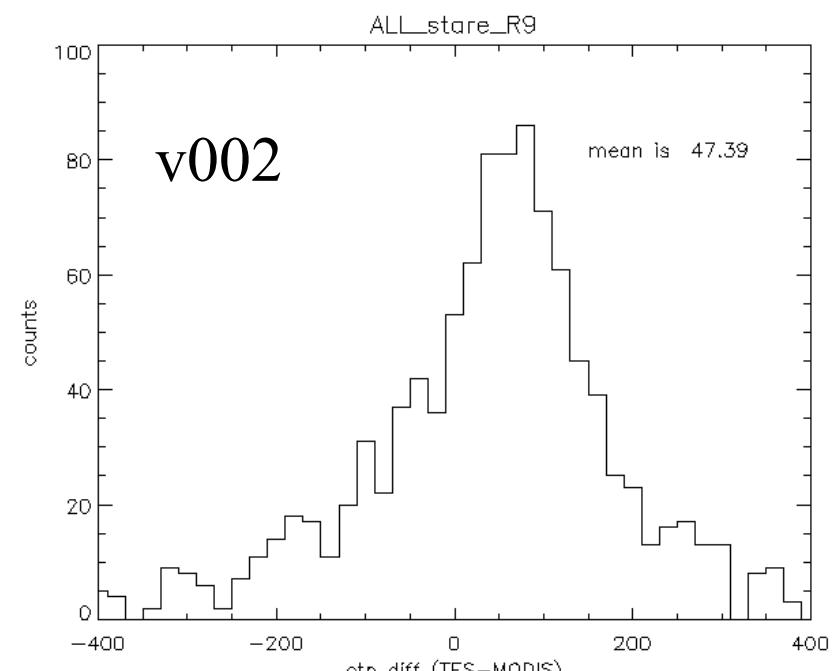
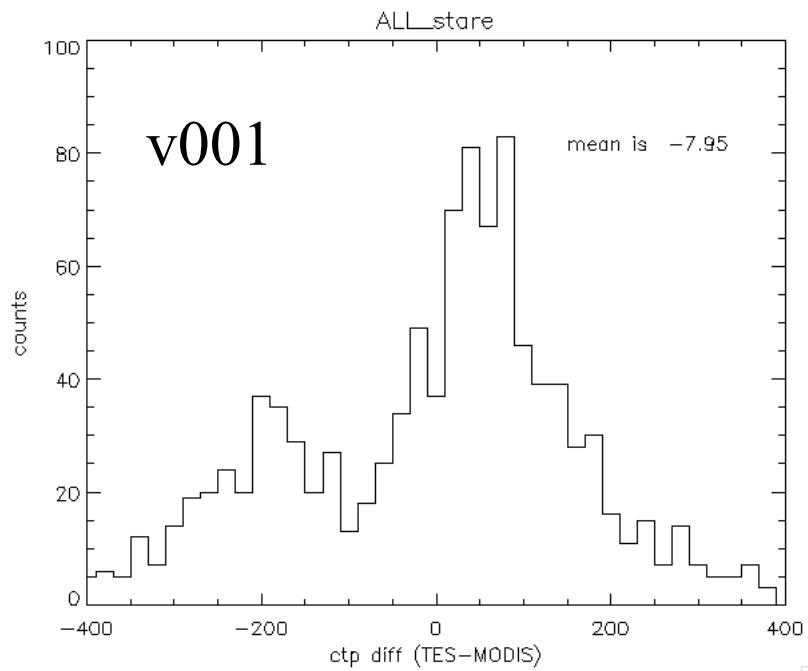
$$\tau_{\nu,z} = K_\nu e^{-\beta(z-z_c)^2}$$

Altitude Effective extinction
(25 frequency values) width parameter
(fixed)

layer thickness ΔS

Initial guess: cloud pressure = 500 mb. Cloud extinction by Brightness temperatures between observed radiance and TES cloud-free initial guess

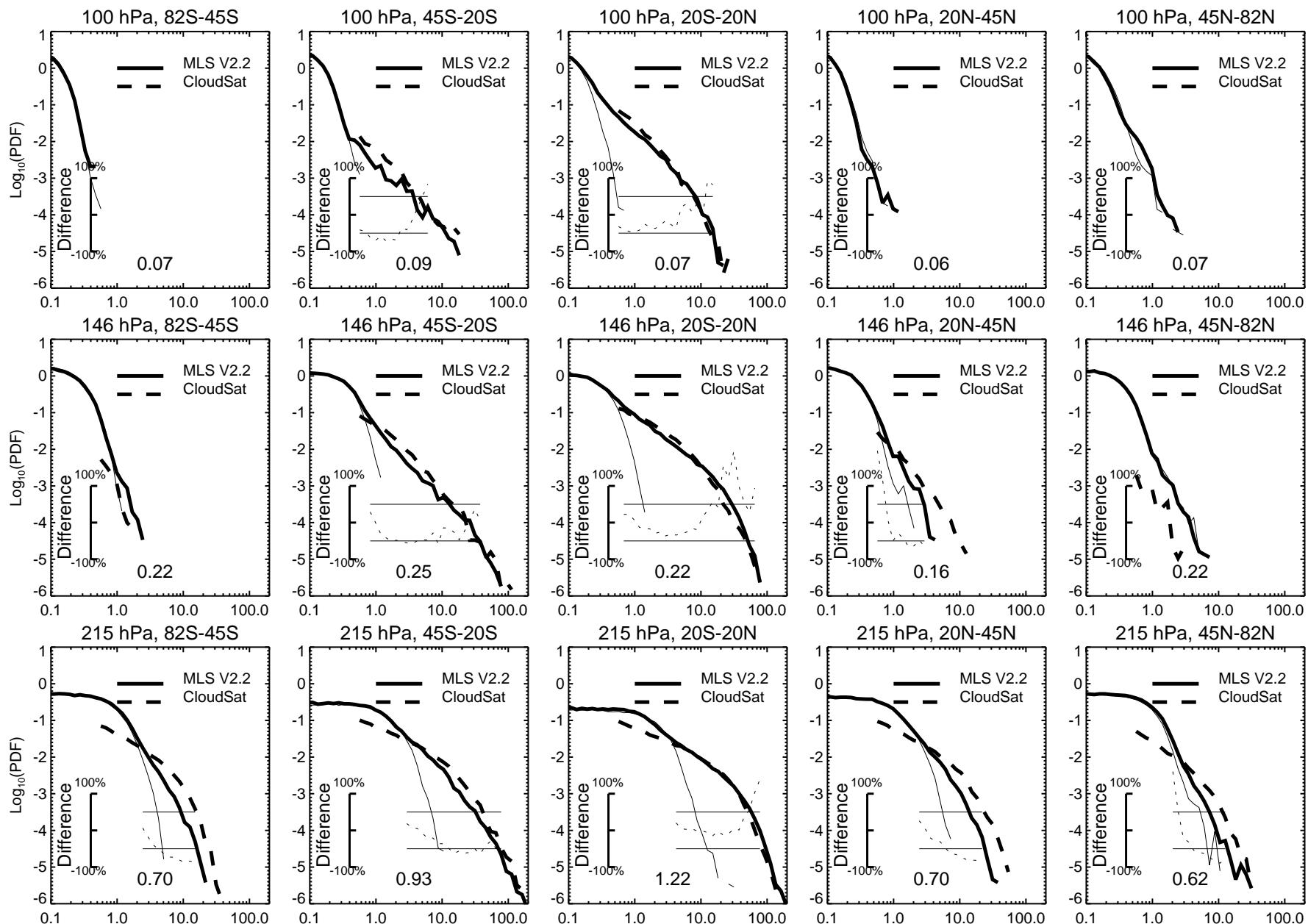
Improvement of v002



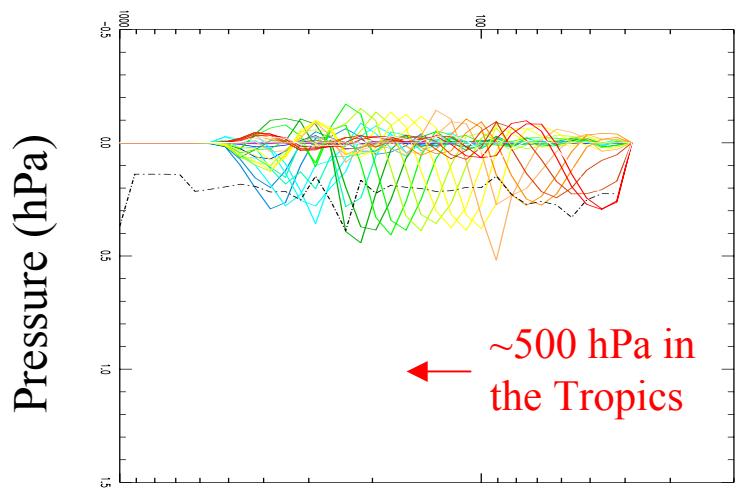
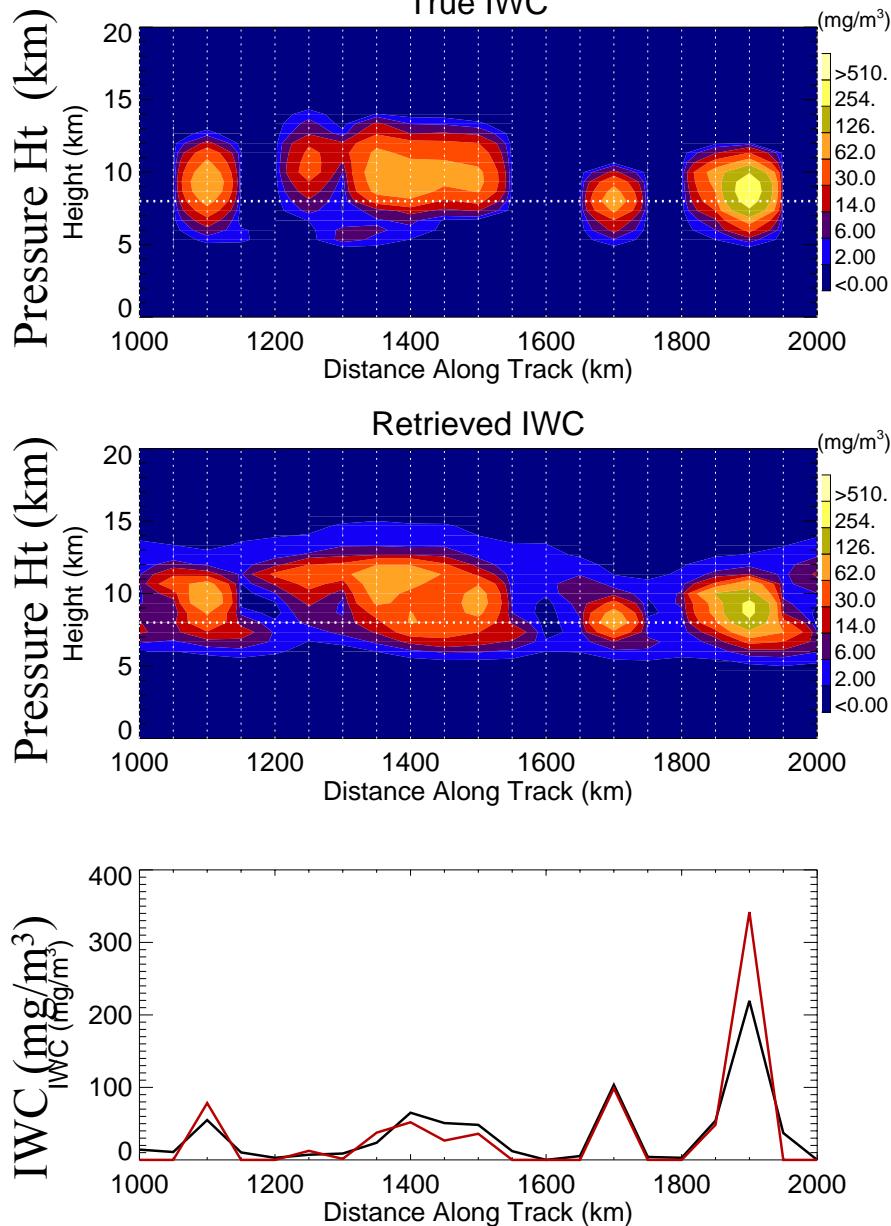
TES – MODIS
Cloud top pressure difference

- No longer have tail of -200 mb differences

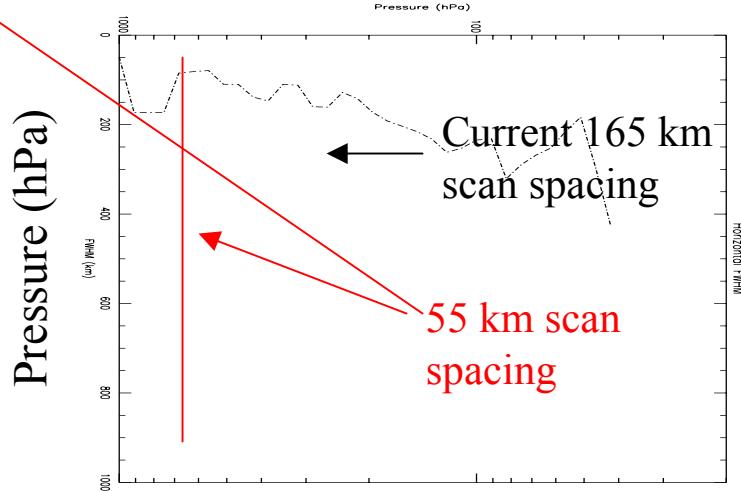
Comparisons of MLS and CloudSat IWC PDFs



A Simulation of Tomographic Retrieval for MLS IWC



Vertical weighting functions



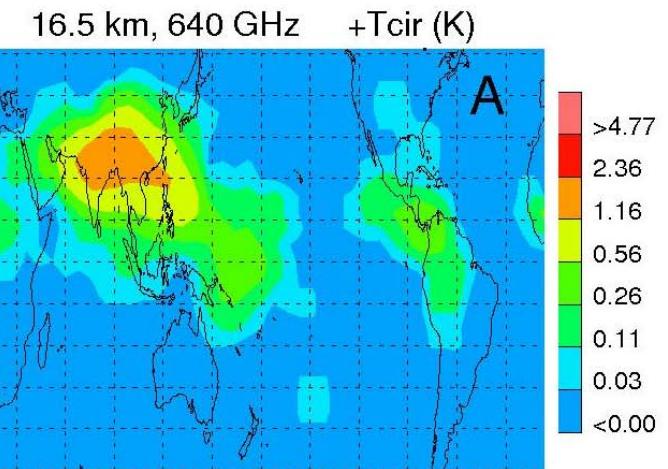
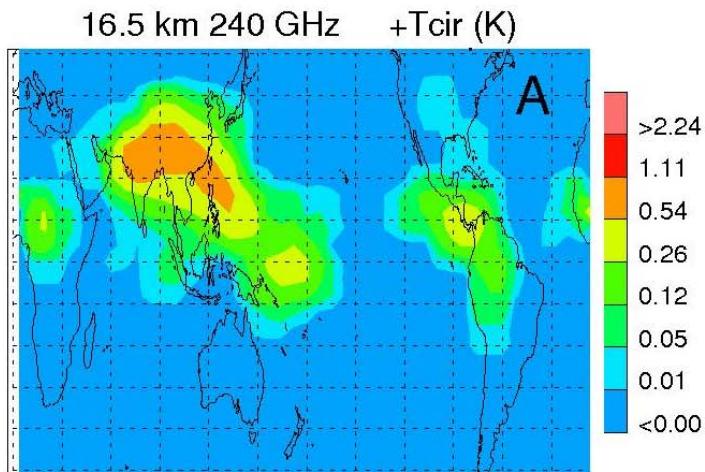
Horizontal resolution (km)

Wu

Small- and Large- D_{mm} Clouds: from MLS 240:640 GHz Cloud-Induced Radiances (T_{cir})

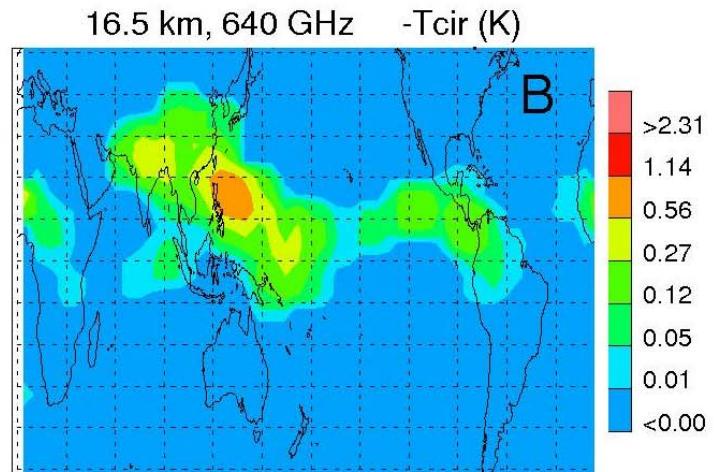
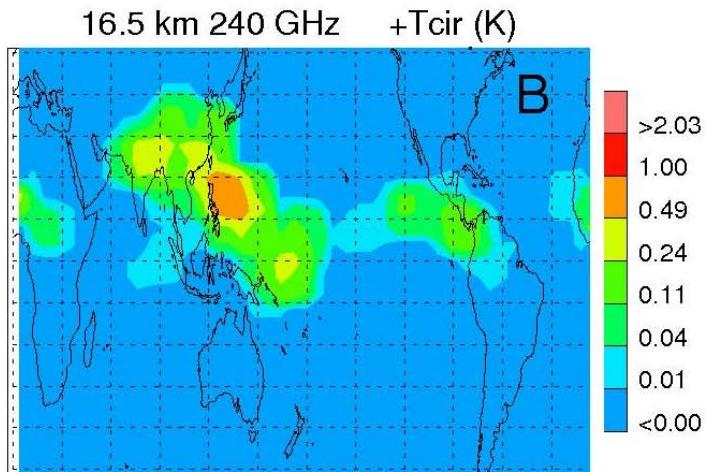
16.5 km

Small- D_{mm}



Large- D_{mm}

July 2006



Statistical Summary

Comparison

SAGE – HIRDLS
cloud top pressure

HALOE – HIRDLS
cloud top presssure

PSC, T < 195 K area

CALIPSO – HIRDLS
horizontal cloud scale

HALOE – HIRDLS, OLR

Correlation Coefficient

0.85 (time < 6 hrs, dist < 100 km)

0.87 (tropics)
0.93 (mid-latitudes)

0.92

0.99

0.99

Correlations vary from 0.45 to 0.85 as time and space distance decreases

Table 1. The sensitivity of HIRDLS and SAGE III cloud top pressure correlations to observation distance and time separations.

Distance, Km	Time, hours			
	0-6	0-12	0-18	0-24
0-100	0.85	0.85	0.59	0.55
100-200	0.77	0.75	0.57	0.54
200-300	0.72	0.68	0.51	0.49
300-400	0.64	0.62	0.45	0.45